

1    CLAIMS

2    What is claimed is:

3       1. A method to detect dead zones in a wireless network,  
4       said network having a plurality of users being  
5       interconnected within the wireless network, said method  
6       comprising:  
7       a first user communicating via said wireless network,  
8       the first user measuring and detecting a message error  
9       rate while communicating,  
10       said first user broadcasting an error message to a base  
11       station when the error rate exceeds an error threshold  
12       level,  
13       said base station obtaining a location of the first user,  
14       said base station incorporating the location in a  
15       database of dead zones for the wireless network.

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16 2. A method as recited in claim 1, wherein each of a  
17 subset of the users has a mobile unit forming a mobile  
18 user connection with the wireless network

19 3. A method as recited in claim 1, wherein the wireless  
20 network includes a plurality of cellular phones.

21 4. A method as recited in claim 1, wherein the wireless  
22 network includes a plurality of portable computing  
23 devices interconnected via a wireless local area network.

24 5. A method as recited in claim 1, further comprising a  
25 step of deploying a subset of the users within at least  
26 one building.

27 6. A method as recited in claim 5, further comprising  
28 the step of forming a map of dead zones in said building.

29 7. A method as recited in claim 1, wherein the step of  
30 error detecting includes cyclic error detection.

31 8. A method as recited in claim 1, wherein the step of  
32 error detecting includes performing parity checking.

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33 9. A method as recited in claim 1, wherein the step of  
34 error detecting includes performing a checksum  
35 calculation.

36 10. A method as recited in claim 1, wherein the error  
37 threshold level is one part in a million.

38 11. A method as recited in claim 1, wherein the error  
39 threshold level guarantees clear reception of data.

40 12. A method as recited in claim 1, wherein said step of  
41 broadcasting uses a signal having a high probability of  
42 reception by the base station in a dead zone.

43 13. A method as recited in claim 12, wherein the step of  
44 broadcasting the error message is performed at twice the  
45 power level used in normal message transmission.

46 14. A method as recited in claim 1, wherein the step of  
47 broadcasting employs a different transmission channel  
48 having a greater probability of reception than an  
49 original channel employed by the step of measuring.

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50 15. A method as recited in claim 1, wherein the step of  
51 broadcasting is performed at a lower data rate than a  
52 first data rate employed by step of measuring.

53 16. A method as recited in claim 1, further comprising  
54 the step of replicating the database at at least one  
55 other base station.

56 17. A method as recited in claim 1, further comprising  
57 the step of replicating the database at at least one  
58 other network device.

59 18. A method as recited in claim 1, wherein the step of  
60 obtaining includes rotating a direction of at least one  
61 antenna.

62 19. A method as recited in claim 18, wherein the step of  
63 obtaining employs triangulation.

64 20. A method as recited in claim 18, wherein the step of  
65 obtaining includes employing a wired LAN connecting  
66 multiple base stations.

67 21. A method as recited in claim 1, further comprising:

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68. said first user entering an error transmit mode;

69 said base station issuing at acknowledge to the first  
70 user; and

71 said first user ending the error transmit mode.

72 22. A method as recited in claim 1, further comprising,  
73 said first user entering an error transmit mode, and  
74 wherein the step of broadcasting is repeated a fixed  
75 number of times, and said first user ending the error  
76 transmit mode.

77 23. A method as recited in claim 1, further comprising,  
78 said first user entering an error transmit mode, and  
79 wherein the step of broadcasting is repeated over a fixed  
80 time interval, and said first user ending the error  
81 transmit mode.

82 24. A method as recited in claim 1, further comprising  
83 the step of logging the error message and location, and  
84 the step of broadcasting is delayed for transmittal to  
85 the base station at a later time.

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86 25. A method as recited in claim 1, further comprising  
87 the step of extracting data from a plurality of error  
88 messages, and storing the data in the database for future  
89 retrieval and/or manipulation.

90 26. A method as recited in claim 1, wherein the database  
91 is resident at a network management station.

92 27. A method as recited in claim 25, further comprising  
93 the step of forming a database of error reports, and  
94 extracting a set of features from the database.

95 28. A method as recited in claim 27, wherein said step  
96 of extracting includes determining a level of service  
97 provided by the mobile network to at least the first  
98 user.

99 29. A method as recited in claim 27, further comprising  
100 the step of processing the database to determine an  
101 occurrence of a repetitive time dependent feature.

102 30. A method for a particular member from a plurality of  
103 members to report an error in a mobile network, said  
104 method comprising:

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105 the particular member keeping track of a number of  
106 errored packets occurring in a packet window;

107 the particular member entering an error transmit  
108 reporting mode and reporting an error condition to a base  
109 station when the number of errored packets exceeds an  
110 error threshold; and

111 said base station obtaining the location of the member.

112 31. A method as recited in claim 30, wherein the step of  
113 reporting includes reporting a time of error occurrence.

114 32. A method as recited in claim 30, wherein the step of  
115 reporting includes providing an identity of the member  
116 when the error occurred.

117 33. A method to detect dead zones in a wireless network  
118 employed in an outdoor environment, said network having a  
119 plurality of users and a plurality of base stations being  
120 interconnected within the wireless network, said method  
121 comprising:

122 a first user communicating via said wireless network,

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123 the first user measuring and detecting a message error  
124 rate while communicating,

125 said first user broadcasting an error message to one of  
126 the base stations when the error rate exceeds an error  
127 threshold level,

128 obtaining a location of the first user, and

129 said one base station incorporating the location in a  
130 database of dead zones for the wireless network.

131 34. A method as recited in claim 33 wherein the step of  
132 obtaining includes employing a Global Positioning System  
133 (GPS) module.

134 35. A method as recited in claim 33 wherein the step of  
135 obtaining includes employing a Loran-C positioning system  
136 module.

137 36. A method as recited in claim 33, wherein each of a  
138 subset of the users has a mobile unit forming a mobile  
139 user connection with the wireless network.



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140 37. A method as recited in claim 33, wherein the  
141 wireless network includes a plurality of cellular phones.

142 38. A method as recited in claim 34, wherein a GPS  
143 module is built into a vehicle interconnected with the  
144 wireless network.

145 39. A method as recited in claim 33, wherein a subset of  
146 the users includes a plurality of vehicles interconnected  
147 via a wireless wide area network.

148 40. A method as recited in claim 33, further comprising  
149 a step of deploying a subset of the users within at least  
150 one building.

151 41. A method as recited in claim 33, wherein the error  
152 mobile network includes a plurality of members, said  
153 method further comprising:

154 at least one of said members keeping track of a number of  
155 errored packets in a packet window;

156 entering an error transmit reporting mode when the number  
157 of errored packets exceeds an error threshold; and

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158 reporting an error condition to one of the base stations;  
159 and wherein said step of obtaining is performed by a base  
160 station.

161 42. A method as recited in claim 33, wherein the step of  
162 detecting includes performing cyclic error detection.

163 43. A method as recited in claim 33, wherein the step of  
164 error detecting includes parity checking.

165 44. A method as recited in claim 33, wherein the step of  
166 error detecting includes checksum calculation.

167 45. A method as recited in claim 33, wherein the error  
168 threshold level is one part in ten million.

169 46. A method as recited in claim 33, wherein the error  
170 threshold level guarantees a satisfactory level of  
171 reception of communication data.

172 47. A method as recited in claim 33, wherein the error  
173 message is broadcast with a signal having a high  
174 probability of reception by the base station in a dead  
175 zone.

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176 48. A method as recited in claim 47, wherein the step of  
177 broadcasting the error message is at twice the power  
178 level of normal message transmission.

179 49. A method as recited in claim 47, wherein the step of  
180 broadcasting the error message is via a different  
181 transmission channel with a greater probability of  
182 reception.

183 50. A method as recited in claim 47, wherein the step of  
184 broadcasting the error message is at a lower data rate.

185 51. A method as recited in claim 41, wherein the time  
186 when the error occurred is included in an error message  
187 from the member to the base station.

188 52. A method as recited in claim 41, wherein the step of  
189 reporting includes providing an identity of said at least  
190 one of said members.

191 53. A method as recited in claim 33, wherein the step of  
192 obtaining includes querying a Global Positioning System  
193 to determine the location.

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194 54. A method as recited in claim 33, wherein the step of  
195 obtaining includes querying a Loran-C positioning system  
196 to determine the members location.

197 55. A method as recited in claim 33, further comprising:

198 said first user entering an error transit mode,

199 said one base station issuing at acknowledge to the first  
200 user upon receiving an error message from the first user,  
201 and

202 said first user ending the error transmit mode.

203 56. A method as recited in claim 33, wherein the step of  
204 broadcasting is repeated a fixed number of times.

205 57. A method as recited in claim 33, wherein the step of  
206 broadcasting the error message is repeated over a fixed  
207 time interval.

208 58. A method as recited in claim 33, further comprising  
209 the step of logging the error message and location, and

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210 the step of broadcasting is delayed for transmittal at a  
211 time of low network traffic.

212 59. A method as recited in claim 33, further comprising  
213 the step of extracting data from a plurality of error  
214 messages and storing the data in a database for future  
215 manipulation and/or retrieval.

216 60. A method as recited in claim 33, wherein the  
217 database is resident at a network management station.

218 61. A method as recited in claim 33, further comprising  
219 the step of replicating the database at at least one  
220 other network device.

221 62. A program storage device readable by machine,  
222 tangibly embodying a program of instructions executable  
223 by the machine to perform method steps for notifying a  
224 family of users of a non-operating area of a wireless  
225 network, said method steps comprising:

226 providing a database of non-operating areas of the  
227 wireless network;

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228           one of the users entering a trip route to a G.P.S.  
229   system in the one user's vehicle; and

230           said vehicle querying the database to download the  
231   map for dead zones in the trip route.

232   63.   A program storage device readable by machine as  
233   recited in claim 62, said method steps further comprising  
234   recommending a changed route having a reduced area of  
235   dead zones.

236   64.   A program storage device readable by machine as  
237   recited in claim 63, wherein the changed route is shown  
238   on a G.P.S. screen in the vehicle.

239   65.   A program storage device readable by machine as  
240   recited in claim 62, said method steps further comprising  
241   providing a warning signal to the user indicating that  
242   the vehicle is approaching a dead zone.

243   66.   A program storage device readable by machine as  
244   recited in claim 62, wherein the warning signal includes  
245   an audible alarm.

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246 67. A method for notifying a family of users of dead  
247 zones in a wireless network:

248 providing a database of non-operating areas of the  
249 wireless network forming dead zones;

250 one of said users entering a trip route into a  
251 G.P.S. system within a vehicle; and

252 said vehicle querying the database to download a map  
253 showing any dead zones in the trip route.

254 68. A method as recited in claim 67, further comprising  
255 recommending a changed route having a reduced area of  
256 dead zones.

257 69. A method as recited in claim 68, wherein the  
258 changed route is shown on a G.P.S. screen in the vehicle.

259 70. A method as recited in claim 67, further comprising  
260 activating a warning signal to the one user when the  
261 vehicle is approaching a dead zone.

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262 71. A method as recited in claim 70, wherein the warning  
263 signal includes an audible signal.

264 72. A method as recited in claim 67, further comprising  
265 the one user making a database query of network reception  
266 dead zones, and a network management station responding  
267 and determining if the one user is in or near a dead  
268 zone, and notifying the one user when the step of  
269 determining locates the user in or near a dead zone.

270 73. A method as recited in claim 72, wherein the network  
271 management station can inform the user of an appropriate  
272 step to take to maintain connectivity.

273 74. An error monitoring and collection system for a  
274 mobile network, the system comprising:

275 a plurality of base stations;

276 a plurality of mobile devices wirelessly interconnected  
277 with the base stations, each device being a member of the  
278 mobile network, each of a subset of said devices  
279 including:



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280 an error rate monitor to monitor a reception error rate;

281 a message processor to form and report an error  
282 message to one of the base stations when the reception  
283 error rate rises above a preset threshold.

284 75. A system as recited in claim 74, wherein the error  
285 message is used by the one base station to determine an  
286 identity of a device reporting the error message and a  
287 location of the device at a time when the error occurred.

288 76. A system as recited in claim 75, wherein the base  
289 station sends an acknowledgment to take the device out of  
290 an error reporting mode.

291 77. A system as recited in claim 74, further comprising  
292 a network manager which includes a database that contains  
293 records of all error messages.

294 78. A system as recited in claim 77, wherein the network  
295 manager includes a network processor to extract recurring  
296 error trends.

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297 79. A system as recited in claim 78, wherein the network  
298 processor maps areas of network reception dead zones, and  
299 responds to a member request querying the data base to  
300 determine if the device is entering a dead zone.

301 80. A system as recited in claim 79, wherein the network  
302 processor is capable of informing the user of an  
303 appropriate action to maintain connectivity.